Maize Establishment Trials

Context

A group of farmers in Cornwall have been investigating the effect of alternative cultivation systems on soil health and maize yield. These systems include:

- Strip tillage (cultivating only the drilled strip and leaving the rest unmoved)
- Disc cultivation (cultivating the whole field to shallower depth without full inversion)
- Direct drilling (placing the seed into the soil without any prior cultivation)

By testing alternatives to ploughing, farmers are hoping to reduce the harmful impact of maize growing on soil structure, reducing the risk of erosion and runoff and reducing costs by using less fossil fuels.

The trial was inspired by Catherine and Malcolm Barrett following their own trials at their farm. It is part of the Farm Net Zero project and funded by the National Lottery Community Fund.

The problem/ solution

Maize is a very valuable silage crop for the dairy industry due to its high starch and high dry matter yield potential. Traditionally maize is established through heavy cultivation, usually including ploughing and power harrowing.

This intensive cultivation destabilises the soil structure, which combined with shallow root systems, wide rows and late harvest period can leave the soil vulnerable to erosion and runoff. This runoff, often phosphate-heavy, can cause pollution to nearby watercourses, as well as depleting the soil. It was hoped that, if done well, maize yield could be sustained and soil health improved with less cultivation.

What we did

A number of different farmers took part over three years. Each chose two establishment methods to trial and split their fields accordingly. Some farmers chose to split their fields again (chequerboard) and undersow their maize with cover crop mixes.

Soil samples and yield analysis were taken after harvest to assess any differences due to drilling practice. At one farm the legacy effects on the soil a year later were also analysed.

Results:

Strip till vs ploughing:

- 5% lower yield in strip tilled plots than ploughed strips
- Strip till had significantly lower cost of production with less time and fuel use.
- Strip till had more weeds despite the same herbicide treatments on all plots.

Strip till vs light (disc) cultivations vs direct drilling:

- Highest yield in strip till plot followed by the min-till plot.
- The lowest yield was the direct drilled plot, although differences were not large.

Disc cultivations (Sumo trio cultivator) vs inversion ploughing.

2 grass seed mixes were undersown (cross drilled). Harvest was carried out using a John Deere 9500 harvester fitted with a weighing system, so the results were very accurate and are set out in the table below:

	Disc based	Plough based
Yield t DM/ ha	12	11.4
Dry matter %	35.2	34
Starch %	31.3	30.2

Plough vs (Mzuri) direct drilled

The plants in the ploughed (control) plot were taller and thinner than those in the direct drilled area, consequently there was also evidence of lodging in the ploughed parts. Some of that could be explained by differing drill widths-760mm for plough based and 640mm for Mzuri.

	Whole plant		Cobs		
	Yield t/ha	% control	Yield t/ ha	% control	Cobs % of crop
Average strip till plot yield	35.42	88.11	12.08	93.39	34.12
Average control plot yield	40.20	100.00	12.94	100.00	32.19

Cobs were larger in the strip plots and that is reflected in the higher cob weight and overall cob percentage of total yield. Although crop yield was higher in the ploughed plots, results were not significantly different statistically

Conclusions

Costs: This trial demonstrates that ploughing is not essential to grow maize. When costs including fuel use and time are accounted for, the higher costs of plough-based systems were not covered by extra yield in these trials.

Weeds: Although there was a trend towards more weeds in non-ploughed plots, these were grass weeds and biennial crops like thistles which were not effectively controlled by the pre-drilling glyphosate. This demonstrates the role that ploughing does have as part of the weed control strategy in Maize.

For further information and more in depth results and discussion, please see the results section of the webpage: https://www.innovativefarmers.org/field-labs/fnz-maize-field-lab/